IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)
	)
JEFF SCHULZ	)
	)
Serial No. 09/678,827	)
	)
Filed: October 4, 2000	) APS/PORT MIRRORING
	)
Art Unit: 2667	)
	)
Patent Examiner:	)
	)
Kamran Emdadi	)

Pittsburgh, Pennsylvania 15213

July 19, 2005

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 C.F.R. §1.132

I, Ansel M. Schwartz, hereby declare that:

I am the attorney of record for the above-identified patent application.

I assisted in the preparation of the above-identified patent application and am the attorney who filed the above-identified patent application with the U.S. Patent and Trademark Office.

I worked with the inventor of the above-identified patent application to prepare the above-identified patent application.

Attached herewith is an Invention Disclosure Form executed by the inventor on January 7, 2000. The Invention Disclosure Form was executed by two witnesses on the same day as the inventor executed the Invention Disclosure Form.

I am also the attorney of record and prepared and filed with the inventors the reference cited in the Office Action dated April 19, 2005, having U.S. Patent No. 6,473,435, cited against the above-identified patent application.

The above-identified patent application, as well as the reference, arose out of a project known as the BFS switch by the real party in interest.

The above-identified patent application, as well as the reference, are owned by the same assignee.

I have prepared and filed approximately 10 patent applications, with the assistance of the respective inventors which arose out of the same project by the real party in

interest. Some patents which issued from this project are 6,851,035; 6,463,063; and

6,906,999. All these patents are owned by the same assignee.

Several different inventors worked on the project, and each appropriate inventor

was associated with a respective patent application.

Any invention disclosed but not claimed in the reference was derived from the

inventor of the above-identified patent application and is thus not the invention "by another".

I further declare that all statements made herein of my own knowledge are true

and that all statements made on information and belief are believed to be true; and further, that

these statements are made with the knowledge that willful false statements and the like so made

are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United

States Code, and that such willful false statements may jeopardize the validity of the

application or any patent issuing thereon.

_____
Date

_____
Ansel M. Schwartz

INVENTION DISCLOSURE FORM

Proprietary Information

Prepare an original and two copies. The original and each copy must be signed by the inventor(s) and witnessed by two individuals. Send the original and copies and any additional documentation to _____.

1. Title of invention   APS/Port mirroring approach in BFS ____

2. Problem which the invention solves. (Identify relevant prior art here)

APS (automatic protection switching) is a network level redundancy protocol defined for networks based on Sonet, a popular telecommunications standard. This disclosure covers how the APS is implemented for the BFS dequeue operation and the interaction between the APS scheduling and the backpreassure algorithm between the memory controller and the separator on the BFS switch fabric.
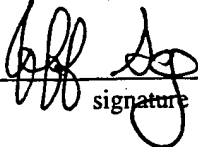
3. Inventor's statement of value of the invention.

This technique is an efficient technique for implementing redundancy when the fabric and port redundancies are not tied together.

4. The following dates apply to the invention:

   (a)   First conceived on __8__/_1___/_99___.
   (b)   First recorded on __1__/_7___/_2000___ in disclosure
   _____.
   (c)   Construction of invention completed _NA___/____/____.
   (d)   First tested ___NA__/____/____ by _____.
   (e)   Discussed orally with others outside _NA_____ on __/__/__.
   (f)   Described in printed publication on _NA___/____/____.
   (g)   First offered for sale _NA___/____/____ to _____.

Inventor(s) Jeff Schulz _____   _____   1/07/00 _____
                  (print or type full name)   signature   dated

Inventor(s) _____   _____   _____
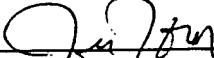   (print or type full name)   signature   dated
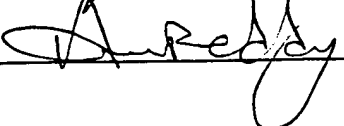
The invention has been witnessed and understood by me.

       Joe Hook _____   _____   1/07/00 _____
                                                                                                      dated

       Veera Reedy_____   _____   1/07/00 _____
                                                                                                      dated

5. Description of invention.

APS involves a special form of multicast. All traffic which goes to one output port must be mirrored on the other port. APS and non-APS ports can be mixed on BFS. The fabric chipset supports APS on a port by port basis. The ports which are backing each other up are physically implemented on different hardware boards to allow for board failure/replacement with APS providing support for user traffic to continue with minimal disruption. Since the APS ports are on different boards, and there are multiple dequeuers in the BFS chipset, the APS port pair can be spread across different dequeuers.

The following characteristics are desired for dequeueing of APS ports:
   a. Traffic flow out of the fabric for the two APS ports to have minimal discrepancy between the two output ports of the same queue. If multiple priorities are being dequeued, the same priority sequence should be followed.
   b. Traffic should be enqueued once and dequeued twice (write once, read many MC technique).
   c. APS traffic scheduling should not block other traffic from being dequeued.
Note that properties a and c generally work against each other.

These characteristics are preserved by using an implementation which allows one output dequeuer to be up to one priority decision ahead of another output port. For this discussion the output ports will be notated Pa and Pb. This is implemented by using a state machine shown below.

Current state	Input	Next State	Comments
			Initial state
Pa=Pb			
Pa=Pb	Read PA with new priority	PA ahead	Port A is going ahead. Store priority decision so port B can follow.
Pa=Pb	Read Pb with new priority	PB ahead	Port B is ahead, store priority decision so port A can follow.
PA ahead	Read PA and exhaust the current priority	PA ahead	Set the flag to the output dequeuer to act as if the queue associated with PA is empty. Port B will continue to dequeue.
PA ahead	Read Rb with new priority	Pa=Pb	New priority is determined by the priority chosen when PA was scheduled in the transition the the PA ahead state
PB ahead	Read Pb and exhaust the current priority	PB ahead	Set the flag to the output dequeuer to act as if the queue associated with BA is empty.
PB ahead	Read Pa with new priority	Pa=Pb	New priority is determined by the priority chosen when PA was scheduled in the transition the the PA ahead state

Inventor(s) Jeff Schulz _____   _____   1/07/00 _____
                (print or type full name)   signature   dated

Inventor(s) _____   _____   _____
                (print or type full name)   signature   dated

The invention has been witnessed and understood by me.

        Joe Hook _____   _____   1/07/00 _____
                                                                                              dated

        Veera Reedy_____   _____   1/07/00 _____
                                                                                              dated

This implementation needs a small number of bits per output port (2 for state) and the ability to allocate two read pointers per queue, plus N bits of priority storage (2 for BFS). However, it has the following properties:

1. Either output port can lead. There is no requirement that traffic must be sent to the primary output port before the secondary.

2. The output ports must be off by no more than one priority decision. If one output port is connected to a dequeue unit which a large amount of congestion and one to a dequeue unit with a small amount of congestion, the amount of memory wasted for the slower port is bounded.

3. Completely separate decisions on being able to dequeue can be made by the two dequeuers. If one dequeuer gets too far ahead, it looks to that dequeuer as if it has exhausted all of its traffic to dequeue. That dequeuer can then use its output bandwidth to service other ports.

Inventor(s) Jeff Schulz _____   _____   1/07/00 _____
                (print or type full name)   signature   dated

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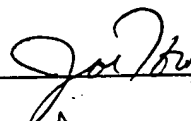   (print or type full name)   signature   dated

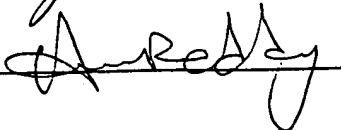The invention has been witnessed and understood by me.

    Joe Hook _____   _____   1/07/00 _____
                                                                            dated

    Veera Reedy_____   _____   1/07/00 _____
                                                                            dated